

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims:

1. (Original) A method of removing filter cake containing a bridging agent soluble in a carboxylic acid salt from a formation fluids producing zone penetrated by a well bore comprising the steps of:

(a) introducing in an aqueous carrier liquid a carboxylic acid ester and a base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith into said producing zone; and

(b) allowing said base to catalyze the hydrolysis of said carboxylic acid ester to form said carboxylic acid salt so that said carboxylated acid salt dissolves said bridging agent and said filter cake is removed.

2. (Original) The method of claim 1 wherein said carboxylic acid salt soluble bridging agent is selected from the group consisting of calcium carbonate bridging agent, magnesium oxide bridging agent, zinc oxide bridging agent, zinc carbonate and calcium sulfate.

3. (Original) The method of claim 1 wherein said carboxylic acid salt soluble bridging agent is calcium carbonate bridging agent.

4. (Original) The method of claim 1 wherein said aqueous carrier liquid is selected from the group consisting of fresh water, unsaturated salt solutions and saturated salt solutions.

5. (Original) The method of claim 1 wherein said aqueous carrier liquid is an unsaturated salt solution.

6. (Original) The method of claim 1 wherein said carboxylic acid ester is an ethylenediaminetetraacetic acid ester.

7. (Original) The method of claim 1 wherein said carboxylic acid ester is ethylenediaminetetraacetic acid tetramethyl ester.

8. (Original) The method of claim 1 wherein said carboxylic acid ester is present in said aqueous carrier liquid in an amount in the range of from about 2% to about 20% by weight of said carrier liquid.

9. (Currently Amended) The method of claim 1 wherein said base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith is selected

from the group consisting of urea and encapsulated bases ~~such as sodium hydroxide and sodium carbonate.~~

10. (Original) The method of claim 1 wherein said base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith is urea.

11. (Original) The method of claim 1 wherein said base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith is dissolved in said aqueous carrier liquid in an amount in the range of from about 0.5% to about 5% by weight of said carrier liquid.

12. (Original) The method of claim 10 wherein said aqueous carrier liquid further comprises a urease enzyme for accelerating the hydrolysis of said ester and forming said carboxylic acid salt at temperatures below about 160°F.

13. (Original) The method of claim 12 wherein said urease enzyme is included in said aqueous carrier liquid in an amount in the range of from about 0.025% to about 1% by weight of said carrier liquid.

14. (Original) A method of placing a permeable gravel pack in a formation fluids producing zone penetrated by a well bore and for removing filter cake therefrom that comprises a bridging agent which is soluble in a carboxylic acid salt comprising the steps of:

(a) combining with an aqueous carrier liquid a carboxylic acid ester and a base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith;

(b) combining gravel with said carrier liquid;

(c) introducing said carrier liquid containing said gravel into said producing zone to form a permeable pack of said gravel in said well bore adjacent thereto;

(d) allowing said base to catalyze the hydrolysis of said carboxylic acid ester and to form said carboxylic acid salt therewith in said carrier liquid remaining in said producing zone and said carboxylic acid salt to dissolve said bridging agent whereby said filter cake is removed; and

(e) producing formation fluids from said producing zone through said permeable gravel pack to the surface.

15. (Original) The method of claim 14 wherein said carboxylic acid salt soluble bridging agent is selected from the group consisting of calcium carbonate bridging agent, magnesium oxide bridging agent, zinc oxide bridging agent, zinc carbonate and calcium sulfate.

16. (Original) The method of claim 14 wherein said carboxylic acid salt soluble bridging agent is calcium carbonate bridging agent.

17. (Original) The method of claim 14 wherein said aqueous carrier liquid is selected from the group consisting of fresh water, unsaturated salt solutions and saturated salt solutions.

18. (Original) The method of claim 14 wherein said aqueous carrier liquid is an unsaturated salt solution.

19. (Original) The method of claim 14 wherein said carboxylic acid ester is an ethylenediaminetetraacetic acid ester.

20. (Original) The method of claim 14 wherein said carboxylic acid ester is ethylenediaminetetraacetic acid tetramethyl ester.

21. (Original) The method of claim 14 wherein said carboxylic acid ester is dissolved in said aqueous carrier liquid in an amount in the range of from about 2% to about 20% by weight of said carrier liquid.

22. (Currently Amended) The method of claim 14 wherein said base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith is selected from the group consisting of urea and encapsulated bases ~~such as sodium hydroxide and sodium carbonate.~~

23. (Original) The method of claim 14 wherein said base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith is urea.

24. (Original) The method of claim 14 wherein said base capable of slowly catalyzing the hydrolysis of said ester and forming a carboxylic acid salt therewith is dissolved in said aqueous carrier liquid in an amount in the range of from about 0.5% to about 5% by weight of said carrier liquid.

25. (Original) The method of claim 14 wherein said gravel is graded sand.

26. (Original) The method of claim 23 wherein said aqueous carrier liquid further comprises a urease enzyme for accelerating the hydrolysis of said ester and forming said carboxylic acid salt at temperatures below about 160°F.

27. (Original) The method of claim 26 wherein said urease enzyme is included in said aqueous carrier liquid in an amount in the range of from about 0.025% to about 1% by weight of said carrier liquid.

28. (Original) A method of placing a permeable gravel pack in a formation fluids producing zone penetrated by a well bore and to remove filter cake therefrom that comprises a calcium carbonate bridging agent which is soluble in a carboxylic acid salt comprising the steps of:

(a) combining with an aqueous carrier liquid an ethylenediaminetetraacetic acid tetramethyl ester and urea for slowly catalyzing the hydrolysis of said ester and forming an ethylenediaminetetraacetic acid ammonium salt therewith;

(b) combining gravel with said carrier liquid;

(c) introducing said carrier liquid containing said gravel into said producing zone to form a permeable pack of said gravel in said well bore adjacent thereto;

(d) allowing said urea to catalyze the hydrolysis of said ethylenediaminetetraacetic acid tetramethyl ester and to form said ethylenediaminetetraacetic acid ammonium salt therewith in said carrier liquid remaining in said producing zone and said ethylenediaminetetraacetic acid ammonium salt to dissolve said calcium carbonate bridging agent; and

(e) producing formation fluids from said producing zone through said permeable gravel pack to the surface.

29. (Original) The method of claim 28 wherein said aqueous carrier liquid is an unsaturated salt solution.

30. (Original) The method of claim 28 wherein said ethylenediaminetetraacetic acid tetramethyl ester is dissolved in said aqueous carrier liquid in an amount in the range of from about 2% to about 20% by weight of said carrier liquid.

31. (Original) The method of claim 28 wherein said urea is dissolved in said aqueous carrier liquid in an amount in the range of from about 0.5% to about 5% by weight of said carrier liquid.

32. (Original) The method of claim 28 wherein said gravel is graded sand.

33. (Original) The method of claim 28 wherein said aqueous carrier liquid further comprises a urease enzyme for accelerating the hydrolysis of said ester and forming said carboxylic acid salt at temperatures below about 160°F.

34. (Original) The method of claim 33 wherein said urease enzyme is included in said aqueous carrier liquid in an amount in the range of from about 0.025% to about 1% by weight of said carrier liquid.